

Hygienic absorbent with odour control

[0001] The present invention relates to a superabsorbent material for use in hygienic absorbent products such as diapers, sanitary napkins and the like, which has enhanced odour control and prevents bacterial growth and to a method of producing such material.

[0002] Superabsorbent materials of various types are known in the art. Examples are crosslinked polyacrylates and polysaccharides grafted with polyacrylates. A problem related to the use of superabsorbent materials is the odour caused by urine components, which cause superabsorbent materials to become objectionable long before there maximum absorbing capacity has been used. As the malodorous compounds are often alkaline materials such as amines, it has been proposed to improve odour control by adding acids to the superabsorbent material. However, the use of acids has disadvantages in that acids will lead to skin irritation.

[0003] US 4,685,909 discloses disposable diapers and the like containing polymeric acidic pH control agents such as cellulose phosphate and polyacrylic acid.

[0004] It has been found that a superabsorbent material with improved odour control can be produced by incorporating in or combining with the superabsorbent material a non-acidic, alkali-neutralising compound selected from acid anhydrides, lactides, lactones and hydrolysable esters.

[0005] Lactides include cyclic esters of hydroxy acids, especially  $\alpha$ -hydroxy acids such as glycolic acid and lactic acid (2,5-dioxo-1,4-dioxanes). Lactones include cyclic esters of hydroxy acids, especially  $\gamma$ - or  $\delta$ -hydroxy acids such as butyrolactone, valerolactone, gluconolactone, glucuronolactone and corresponding lactones of other sugar acids. Examples of hydrolysable esters are cellulose acetate and starch acetate. The non-acidic compound can be chemically bound to the superabsorbent material in the form of esters such as acetylated cellulose. Anhydrides are also suitable, although they are somewhat less preferred than lactides, lactones and hydrolysable esters, possibly because their susceptibility to hydrolysis is too high. They include anhydrides of carboxylic acids, especially cyclic anhydrides of dicarboxylic or polycarboxylic acids such as succinic, glutaric, maleic, citraconic, phthalic acid.

[0006] The amount of neutralising agent (e.g. lactide and lactone) to be incorporated in or to be combined with the superabsorbent material can be 1-20 % by weight, preferably 3-12 % by weight with respect to the weight of the superabsorbing polymer. The amount

of neutralising agent can also be expressed in molar equivalents. In particular the amount is 0.05-1 mmol, in particular 0.15-0.6 mmol per g of superabsorbing polymer.

[0007] An agent facilitating hydrolysis may be added to the neutralising agent. A suitable example is a hydrolysing enzyme, such as a lipase.

- 5 [0008] The superabsorbent materials according to the invention can be used for absorbing fluids, especially body fluids that may produce alkaline odorous components such as urine. The materials may be incorporated in any absorbent article such as sanitary napkins, incontinence pads and baby diapers. As a model for human urine, so-called synthetic urine (SU) is used to study the effectiveness of the superabsorbent materials. The composition of SU is given in table 1 below:

[0009]

**Table 1**

component	g/l	mmol/l
magnesium sulphate	0.42	3.5
potassium chloride	4.50	60
sodium chloride	7.60	130
urea	18.00	300
calcium sulphate dihydrate	0.34	2
potassium dihydrogen phosphate	3.54	26
disodium hydrogen phosphate	0.745	5.3
Triton X-100, 0.1%	1.00	
pH 5.9-6.0		

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**Example 1: Baby diaper**

- [0010] In a baby diaper containing 13 g of polyacrylic acid as absorbent (Libero Maxi Girl), four different alkali-neutralising substances were placed under a non-woven of the diaper and on top of the pulp. 250 ml of SU was added to the diaper. After the addition, the pH was measured at six different places on the non-woven using a contact electrode, and the values were averaged. The results are summarised in table 2. It can be seen from the table that despite the high buffering capacity of the diaper (>75% of the polyacrylic

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acid being in the sodium salt form), the pH is lowered due to hydrolysis of the acid precursor.

[0011]

Table 2

neutralising substance	amount (mg)	amount (mmol)	pH after 1 h	pH after 2 h	pH after 5 h
none	-	-	5.75	5.81	5.92
lactide	577	4.0	5.84	5.80	5.47
$\delta$ -gluconolactone	1430	8.0	5.96	5.85	5.33
maleic anhydride	600	6.1	5.70	n.d.	5.43

**Example 2: Sanitary napkin**

[0012] In a sanitary napkin (Libresse) containing CTMP (chemically treated mechanical pulp) as absorbent, three different alkali-neutralising substances were placed in the middle of the CTMP of the napkin. 15 ml of SU was added to the napkin. After the addition of the urine, the pH was measured as six different places on the non-woven using a contact electrode, and the values were averaged. The results are summarised in the following table 3. The table shows that addition of lactide lowers the pH quickly, whereas the same amount of (maleic) anhydride results in a slower but continuing pH decrease. A direct acid (citric acid) tend to be too acidic.

[0013]

Table 3

neutralising substance	amount (mg)	amount (mmol)	pH after 2 h	pH after 5 h
none	-	-	5.76	5.67
lactide	34	0.23	4.51	4.56
maleic anhydride	23	0.23	5.36	4.32
citric acid	49	0.23	3.98	3.80

**Example 3: Baby diaper**

[0014] 250 ml SURM was added to a baby diaper (Libero maxi). Different amounts of glycolide, from 0.2 g to 1.6 g per diaper, were put into diapers, under the non-woven of the diaper and on top of the pulp. Each diaper also contains 1 g of lipolase 100 T (Novo Nordisk). For each measurement the pH of the diaper was measured on the non-woven at six different places with a contact electrode. The averaged results are shown in table 4.

[0015]

**Table 4**

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Amount of glycolide added		Starting	pH	pH	pH
g	mmol	pH	After 1 hour	After 2 hours	After 5 hours
0.2	1.7	6.0	5.1	5.0	5.0
0.4	3.4	5.9	5.1	4.9	4.9
0.8	6.9	5.9	4.4	4.9	4.8
1.6	13.8	5.9	4.8	4.6	4.6